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DEGREE OF ACCURACY IN CENSUS STATISTICS OF AGRICULTURE*.

By L. G. Powers, *Chief Statistician, Division of Agriculture, Bureau of the Census.*

In making a brief address upon the subject of the degree of accuracy, or margin of error, in the Census statistics of agriculture, permit me to call your attention at the outset to the unique character of those statistics. They are the only ones compiled by the Bureau of the Census that have an intimate relation with the prices of commodities in the markets of the world. They are also the statistics to which the students of social conditions look for their final answer to many questions that are now agitating the public.

The prices of agricultural commodities are in great measure determined by their quantity, but the suspicion has arisen in the minds of the American people that the prices of many of the necessaries of life are not moving up and down in accordance with the general law of supply and demand, but have been determined in large measure by the action of trusts and other combinations in restraint of the freedom of trade. The people of this country, and especially the students of agricultural and social conditions, are looking for the publication of the Census figures of agriculture as the only trustworthy data for reaching any definite conclusion as to the soundness or baselessness of this suspicion. They look to the Census statistics of agriculture to determine whether any class of agricultural commodities have decreased in their production relatively to population and market demand to such a degree as to give rise to the enhanced prices of the day which so increase the cost of living of the average city dweller. The commission man, mechanic, and the humble toiler thus have a supreme interest in these statistics, and for that reason it is imperative that those using them should have some knowledge concerning their degree of accuracy or the margin of error which accompanies them. A knowledge of this accuracy or margin of error is thus of vital interest to every person in this country, and this knowledge is more important with reference to the Thirteenth Census of agriculture than any Census that has preceded it. For this reason those connected with the Thirteenth Census have from the outset been giving great consideration to the subject, and in the final volumes of the Census much data will be published to assist the average student in forming his own opinion concerning the same.

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*Address delivered at special session on Agricultural Statistics, annual meeting of the American Statistical Association, St. Louis, Mo., December 29, 1910.

Permit me at this time to call your attention to some of the measures of accuracy that are available, and the results of applying those measures to the Census reports. I will confine my remarks in this field principally to the data for the state of Iowa, which have been tabulated to a greater degree than that for any other state.

The farm land included in the census of agriculture in such a state as Iowa is very largely assessed for taxation purposes as "acre property," and there is but little land assessed as "acre property" that is not also used more or less for agricultural purposes. The margin of variation between the land assessed as acre property and that which is properly classed as farm land under the definition of the Census is for Iowa ascertained approximately. It is not more than one fourth of one per cent., and may not exceed one eighth of one per cent. of the total land area assessed as acre property. At the present time, the area assessed as acre property in Iowa is approximately 34,651,000 acres, while the area returned by the Thirteenth Census aggregates 33,930,137 acres. The Census acreage is approximately 720,000 acres, or 2.1 per cent., short of the total area assessed as acre property. If the amount of land assessed as acre property but never used for agricultural purposes constitutes, as stated above, the maximum of one fourth of one per cent. of the total of such land, then the Census report falls short of a complete return of all agricultural land 1.9 per cent.; while the percentage of shortage is 2.0, providing the aggregate of land assessed as acres and never used for agricultural purposes constitutes only one eighth of one per cent. of the whole.

Under no circumstances, therefore, can the margin of omission of farm land by the Census exceed 2.0 per cent. of the total. Its degree of accuracy, therefore, approximates at least 98.0 per cent. of what is called for by theoretical perfection. As a matter of fact, the practical results attained by the Census should be given a greater percentage than the one here stated, and for the following reason: The Census seeks only to secure reports from lands that were actually used either in 1909 or 1910 for agricultural purposes. The enumerators were directed to omit from their reports all lands that were sometimes used for agricultural purposes, but were not so used in 1909 or 1910. This instruction was made to place the Census returns of agriculture on a basis practically identical with that of the census of manufactures, from which all reports of plants idle for a whole year were excluded. In the state of Iowa in the latter part of the decade just closed, there were in many counties long periods of heavy rain which rendered it impossible for the owners to make any use of undrained farms in 1909 or 1910. All the information thus far secured with reference to the amount of the agricultural land unused in 1909 and 1910 by reason of this and other causes indicates that it constituted at least one third and possibly one half of the assessed acreage that was not included in the Census report. If allowance is made for this known factor, the amount of agricultural land in use in 1909 or 1910 that was not included in the Census enumeration could not have exceeded 1.3 per cent. and probably did not exceed 1.0 per cent. of the total area of such land.

Here, then, we have a closer approximation to the relative perfection of the Census report of farm acreage, and are brought face to face with the fact that the margin of error in the Census enumeration of the area of farm land, after allowing for all duplications and omissions, was not to exceed 1.3 per cent. of the whole, and probably was materially less. This is a statement of the aggregate results obtained by the enumeration of over 200,000 farms, which constituted approximately one thirtieth of the farm area of the United States.

It is without doubt not far from the margin of error that accompanies the Census enumeration in the greater number of the old settled agricultural states of the north. That margin of error increases with the decrease in the density of settlement and the complexity of agricultural conditions. Considering the volume of statistics covered and the field included, it is doubtful if any other branch of Census statistics can be found where the margin of possible error is as small as this of the farm area of Iowa and of the old settled agricultural states, and in no other branch can the actual margin of error be computed with such exactness as is here done for the acres of land in farms.

In a few states, the records of the state auditor, or other official compiling statistics of the number of domestic animals subject to taxation provide data for similar measures of the degree of accuracy of the Census enumeration of domestic animals kept on farms and not on farms. These states are those which have made no material change in the last ten years in their methods of assessing domestic animals. The method of using these figures of the state auditors as measures of the general accuracy of the Census report is necessarily more complex than the one here set forth for testing the general accuracy of the Census report of farm acreage. This greater complexity arises from two factors: first, the Census classification of animals is not the same in 1910 as that employed in 1900; and, further, both classifications differ somewhat from the classifications employed for taxation purposes. But after allowing for these differences, the records of the state auditor for such a state as Iowa lead to the conclusion that the degree of accuracy of the number of domestic animals on hand April 15, 1910, is not greatly variant from that attending the Census enumeration of farm acreage.

As we pass from the enumeration of property as of April 15, 1910, (the date of enumeration) to the Census reports of farming operations and transactions of 1909, we are met at the outset with a greater margin of error. This error, like the error relating to farm land and domestic animals, is more largely an error of omission than one of duplication. There are undoubtedly duplications of farm area as between owners and tenants, and similar duplications of the number of various classes of domestic animals; but these duplications are more than offset by omissions; and hence, the net result is the shortage of reports given, of which mention has been made above. There are duplications of crops and reports of other farm products and transactions of 1909, but these are more fully offset by omissions than in the other cases mentioned.

The principal cause of this greater margin of error expressive principally of omissions of crops and other products and expenses of 1909 than of acres and property of April 15, 1910, arises principally from the fact that a large number of farms changed their operators between the close of the crop year 1909 and the date of enumeration in 1910. The farm operator can give a more correct statement of the property under his control or ownership on the date of enumeration than he can of the crops on that property for the preceding year when it was under the control of another man. He can give a fairly correct statement of his own transactions if he operated the farm the year before, but he has to employ estimates or utilize hearsay information in reporting the crops, other products, and expenses of his farm the preceding year if he did not operate it at that time. This factor of error is further heightened by the fact that many farm operators who have been on their farms but a few months will not make any estimate of the crops, etc., of 1909, and the careless enumerator will secure no information relating to the same. As a result, about 2 per cent. of the Census schedules of 1910 have no reports of crops and other products and expenses of 1909. This omission makes it certain that all the statistics of crops, other products, and expenses of 1909 have a margin of omission of at least 2 per cent.

A careful examination of the schedules of a great many farm operators who were not on the farm in 1909 which they were operating in 1910, leads to the conclusion that when these operators make report of crops and other products and expenses of 1909, they give fairly correct statements of only the principal farm crops, such as the staple crops of their section. They give but very few reports of the minor crops, and their returns of the animal products, as well as purchases of live stock, and farm expenses (especially those for labor, feed, and fertilizer) are quite imperfect; hence it is certain that the margin of error due to omission of all crops, products, and expenses (other than the staple crops) is much greater than 2 per cent.

Those in charge of the statistics of agriculture for the Bureau of the Census will make an earnest effort to present to the public using their statistics data on which those users may form a fairly trustworthy judgment concerning the margin of error, and thus the degree of accuracy that has been attained in all the classes of agricultural statistics compiled by the Census. In this way it is hoped and confidently believed that those statistics will be made of greater actual service to their users than any similar statistics of previous decades.